

# The Sciaenidae of the coastal waters of Visakhapatnam

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(With a plate)

Thirteen species of the family Sciaenidae, popularly known as drums, grunters, croakers or jew fish, are caught practically throughout the year in the coastal waters of Visakhapatnam, where they constitute a minor but valuable fishery by indigenous craft and gear. Most of the catches, mainly by boat seine, are of small to medium-sized specimens.

One of the earliest Indian records of sciaenids is from Visakhapatnam by Russell (1803), who described 6 species. Blyth (1860) recorded 9 species and Day (1878) described 27 species from India. Lloyd (1907) described 5 species of *Sciaena* and 1 of *Otolithus*. Chaudhuri (1923) recorded *Sciaena coibor* and *Umbrina indica* from Chilka Lake. Pillay (1929) reported 3 genera and 7 species from Travancore. Fowler (1933) recognised 8 genera under Sciaenidae and described 53 species from India. Jacob (1948) reported 7 species of Sciaenidae from west coast of the old Madras State. Munro (1955) described 17 species from Ceylon. Seshappa (1956) recorded *Johnius hololepidotus* for the first time from Indian waters.

## MATERIAL AND METHODS

The material for the present work was collected in the fishing villages of Visakhapatnam, from catches in coastal waters by boat seine and gill net. The linear measurements are based on specimens preserved in 5% formalin. The body proportions and length of air bladder described for the various species in the text, are given as percentage of standard length. The size range of the specimens examined refers to the standard length.

## OBSERVATIONS

The sciaenids are characterised by a fairly elongate body, covered with cycloid and/or ctenoid scales, with a spinous dorsal consisting of ten spines and a soft dorsal having a feeble spine and a varying number of

rays ; the two dorsals are not completely separated. Anal fin of two spines (first spine short) and 7 rays much shorter than soft dorsal. Caudal truncate, emarginate or pointed but never forked. Jaws equal or sub-equal. Air bladder present, physoclistous.

Thirteen species of sciaenids belonging to five genera are described from the coastal waters of Visakhapatnam, in the western part of the Bay of Bengal.

## KEY TO GENERA

- 1a. Solid barbel on chin.....*Dendrophysa*
- 1b. No barbel on chin
  - 2a. Caniniform teeth present ; caudal pointed
    - 3a. Lower jaw prominent, no pores on chin.....*Otolithes*
    - 3b. Lower jaw shorter than upper, chin with pores.....*Otolithoides*
  - 2b. No caniniform teeth ; chin with pores
    - 4a. Soft dorsal and anal covered with small scales.....*Johnius*
    - 4b. Soft dorsal and anal naked, only bases covered with scales.....*Nibea*

## Genus JOHNIUS Bloch

Bloch, 1739, Naturges. Ausländ. Fische, 7 : 132. Type *J. carutta* Bl.

Bleeker (1863) split the genus into *Johnius* and *Pseudosciaena*, the latter distinguished by an inner row of enlarged teeth on the lower jaw, absent in the former. According to Weber & De Beaufort (1936), *Pseudosciaena* has also terminal mouth and oblique cleft whereas *Johnius* has inferior mouth and horizontal cleft. However, Fowler (1933) and Munro (1955) have treated *Pseudosciaena* Bleeker as a synonym of *Johnius* Bloch.

*General characters*

Lower jaw equal to or slightly shorter than upper. Chin usually with conspicuous pores, no barbel under symphysis. Gill rakers short. No caniniform teeth. Spinous dorsal with ten spines and soft dorsal with one spine and 23-31 rays and anal fin with two spines and 7 rays. Pectoral rays 14-20. Of the 13 species of sciaenids from the coastal waters of Visakhapatnam 5 belong to genus *Johnius*.

KEY TO THE SPECIES OF *Johnius*

- 1a. Lateral line broad and conspicuous.....*carutta*
- 1b. Lateral line narrow
  - 2a. Six dark brown vertical bands. Carrot-shaped air bladder with 16-18 caecae .....*aneus*

- 2b. No bands.
- 3a. Air bladder hammer-shaped with caecae. No dark spot on pectoral axilla.
- 4a. Depth 31·57-33·34. Air bladder with 13-14 caecae.....*dussumierii*
- 4b. Depth 32·32-33·80. Air bladder with 14-15 caecae.....*belengerii*
- 3b. Air bladder carrot-shaped. No caecae; instead 2 horn-like projections anterolaterally; A dark spot on pectoral axilla.....*axillaris*

### 1. *Johnius carutta* Bloch

*Johnius carutta* Bloch, 1793. Naturgesch Ausländ. Fische. 7 : 133, pl. 356  
(Type locality : Tranquebar).

*Diagnosis* : D. X+I 26-29, A. II 7, P. 14-17, V. I 5, Vert. 25.

Depth 28·89 to 29·72 ; head 32·00 to 33·54 ; snout 9·80 to 10·00 ; eye 7·81 to 9·80. Upper jaw overlaps lower. 5 pores on chin. A row of pores across snout. Lateral line broad and conspicuous and curves gradually to below end of anal fin behind which it runs straight. G.R. 3-5+7-10. Scales on head, cheeks and suborbitals cycloid and on body ctenoid.

*Colour* : Purplish brown above, light brown below. First dorsal dark, other fins with grey edges.

*Air bladder* (Plate, 1) : The air bladder of *J. carutta* is hammer-shaped, having 14-15 caecal outgrowths with very small branches except the last two caecae which are undivided. The number of caecae is not equal on both sides ; in the 122 air bladders examined there was a difference of  $\pm 1$  on one side. Last caecum extends behind pointed posterior end of air bladder. Length of air bladder 37·48 to 44·87.

The size of the 158 specimens examined ranged between 54·7 mm. and 175·0 mm.

### 2. *Johnius aneus* Bloch

*Johnius aneus* Bloch, 1793, Naturgesch Ausländ. Fische. pt. 7 : 135, pl. 257  
(Type locality : Malabar).

*Diagnosis* : D. X+I 23-25, A. II 7, P. 15-17, V. I 5, Vert. 25.

Depth 33·08 to 34·76 ; head 35·56 to 37·36 ; snout 7·96 to 8·35 ; eye 8·42 to 8·98. Upper jaw overlaps lower. Chin with 5 pores. Operculum with 2 spines. Anal originates below 12th to 14th dorsal ray. G.R. 4-7+9-14. Scales on head, preopercle and cheek cycloid, on body ctenoid. Pectorals about as long as head without snout,

*Colour* : There are 6 dark brown vertical lines on the sides of the body, of which 2nd and 3rd extend below lateral line.

*Air bladder* (Plate, 2) : Day (1878) described the air bladder of *J. aneus* as an oval structure having about 30 lateral processes, but the present study, based on the examination of 80 specimens, shows that the number of caecae is only 16-18. The anterior caecae are shorter than in the other species of *Johnius* but posteriorly the caecae are elongated and the last 2 to 4 caecae are much longer than the rest. The pointed posterior end of air bladder extends beyond last caecum. Length of air bladder 37.18 to 45.45.

The 93 specimens examined ranged between 25.7 mm. and 187.0 mm.

### 3. *Johnius dussumierii* (Cuv. & Val.)

*Corvina dussumieri* Cuvier & Valenciennes, 1830. Hist. Nat. Poiss. 5: 119 (Type locality : Malabar).

*Diagnosis* : D. X+I 26-30, A. II 7, P. 15-18, V. I 5, Vert. 25.

Depth 31.57 to 33.34 ; head 31.20 to 33.11 ; snout 7.14 to 7.32 ; eye 8.19 to 8.87. Lower jaw shorter ; 5 pores on chin ; opercle with two flat weak spines, preopercle with two or three small spines. Scales cycloid on head and operculum, ctenoid on body. Lateral line slightly arched to below middle of soft dorsal. Origin of anal below middle of soft dorsal. Caudal rounded. First ventral ray filamentous and prolonged. G.R. 4-7+10-14.

*Colour* : Dark brown above, lighter on sides ; ventral side whitish. Spinous dorsal black ; soft dorsal and caudal grey.

*Air bladder* (Plate, 3) : Glistening white. Anterior side bulges laterally into rounded prominence. Caecae 13 to 14, last caecum undivided, does not extend behind pointed posterior end of air bladder which extends a short distance behind vent. Length of air bladder 37.15 to 37.18.

A total of 107 specimens between 44.1 mm. and 141.0 mm. were examined. Occurs practically throughout the year.

### 4. *Johnius belengerii* (Cuv. & Val.)

*Corvina belengerii* Cuvier & Valenciennes, 1830. Hist. Nat. Poiss. 5: 120. (Type locality : Malabar).

*Diagnosis* : D. X+I 28-29, A. II 7, P. 17, V. I 5, Vert. 25.

Depth 32.32 to 33.80 ; head 31.62 to 34.56 ; snout 7.86 to 7.95 ; eye 8.20 to 8.86. Free border of snout deeply quadrilobate. Chin with 5 pores, G.R. 3-7+9, short, Scales ctenoid except on snout and below

eye where they are cycloid. Origin of anal below 12th dorsal ray. Length of pectoral equals head length excluding snout. First ventral ray with filamentous prolongation. A blotch on operculum.

*Colour* : Brown above, white below. Spinous dorsal, anal and ventrals with dark edge. Pectorals pale yellow.

*Air bladder* (Plate, 4) : Shape of air bladder more or less similar to that of *J. carutta* and *J. dussumierii* but number of caecae 14 to 15. Length of air bladder 38.62 to 39.36.

Rare. Only 2 specimens were obtained in June, measuring 56 mm. and 102 mm.

### 5. *Johnius axillaris* (Cuv. & Val.)

*Corvina axillaris* Cuvier & Valenciennes, 1830, Hist. Nat. Poiss. 5 : 113 (Type locality : Malabar).

*Diagnosis* : D. X+I 25-29, A. II 7, P. 15-18, V. I 5, Vert. 24.

Depth 34.69 to 35.92, head 32.97 to 38.00 ; snout 7.91 to 7.92 ; eye 7.91 to 8.42. Lower jaw slightly shorter than upper. A median pore below mandibular symphysis and two slit-like pores on each side of it. Scales on head and opercle cycloid and on body ctenoid. G.R. 9-12+19-23.

*Colour* : Brownish-grey above, white on ventral side. A black axillary spot which extends considerably above base of pectoral. Upper two-thirds of spinous dorsal, black and first half of soft dorsal, dark.

*Air bladder* (Plate, 5) : The air bladder of *J. axillaris* has the most glistening colour. The anterior rectangular part tapers gradually to posterior end which is pointed. Caecae absent, instead, anterolaterally arise two unbranched horn-like processes directed forward. The entire surface of the air bladder is covered by a thin layer of white fatty substance, whereas in the air bladder of other sciaenids, where caecae are present, only the caecae are covered with this fatty substance. Length of air bladder 33.34 to 51.63.

A total of 445 specimens between 20.5 mm. and 135.0 mm. were examined. Juveniles between 20 mm. to 30 mm. occur in large numbers from March to May.

*Note* : This species possesses all the characters of genus *Johnius* Bloch, 1793 defined by Trewavas (1964 : 110) except that it lacks the paired series of arborescent appendages on the air bladder (*vide* Discussion).

Genus NIBEIA Jordan & Thompson

Jordan & Thompson, 1911, Proc. U.S. Nat. Mus. 39 : 244, 246. Type *Pseudotolithus mitsukurii* Jordan & Snyder.

Snout prominent, with four pores at tip arranged in a transverse row of three above a median pore. Chin with five conspicuous pores. No barbel. Preopercle edge serrated or crenulate. Scales on body ctenoid. Can be distinguished from *Johnius* in that only the bases of soft dorsal and anal are covered by scales.

KEY TO THE SPECIES OF *Nibeia*

- 1a. Five broad black oblique bands on body with two longitudinal rows of black spots on dorsal side.....*maculata*
- 1b. No bands or spots.
  - 2a. Depth 33·02-37·23. Dark spot behind each dorsal spine and ray forming black line along dorsal fin. Air bladder carrot-shaped with 17-20 caecae.....*soldado*
  - 2b. Depth 31·43-31·78. No dark spot behind dorsal spine. Air bladder hammer-shaped with 16-17 caecae.....*sina*

1. *Nibeia maculata* (Bloch & Schneider)

*Johnius maculatus* Bloch & Schneider 1801. Syst. Ichth. : 75.

*Diagnosis* : D. X+I 22-24, A. II 7, P. 16-18, V. I 5, Vert. 25.

Depth 30·46 to 32·08 ; head 31·34 to 32·66 ; snout 8·06 to 8·52 ; eye 8·60 to 8·71. Lower jaw shorter than upper. Transverse row of 4 pores across snout, 1 below mandibular symphysis and 2 more on either side. G.R. 4·5+7·9.

*Colour* : An important diagnostic character is the presence of 5 interrupted broad black bands running vertically : the first arising on the nape passes backward and downward and terminates abruptly after crossing lateral line ; the second, commencing opposite fifth to seventh dorsal spines, passes obliquely downward and terminates above middle of ventral fin ; the third arising below second and third dorsal rays or between the two dorsal fins, runs parallel to second band ; the fourth band commences below centre of second dorsal and descends to the lateral line and the fifth runs parallel to it below last few dorsal rays. In addition, 2 rows of black spots run along the dorsal surface. Fins are grey with small irregular black spots.

*Air bladder* (Plate, 6) : The air bladder of *N. maculata* has a more glistening silvery colour than that of other species. The 16 or 17 caecae are close together, very short and much branched, The last caecum is also

branched. The air bladder suddenly tapers at the posterior end which is without caecae. Length of air bladder 36.48 to 37.25.

This is rather uncommon in the coastal waters of Visakhapatnam. Only five specimens between 58 mm. and 122 mm. were obtained.

## 2. *Nibea soldado* (Lacépède)

*Holocentrus soldado* Lacépède, 1802, Hist. Nat. Poiss. 4 : 344, 389. (Type locality : Cayenna, East Indies).

*Diagnosis* : D. X+I 23-26, A. II 7, P. 15-17, V. I 5, Vert. 25.

Depth 33.03 to 37.23 ; head 34.97 to 36.56 ; snout 9.60 to 10.05 ; eye 6.33 to 7.26. Jaws more or less equal. Preopercle distantly denticulate, opercle with two weak spines. Scales on head cycloid and on body ctenoid. Lateral line strongly arched to below middle of soft dorsal and straight above hind edge of anal. Origin of anal below 9th or 10th dorsal ray. G.R. 4-7+10-14.

*Colour* : Brownish-grey above, whitish below. Fins pale yellow. Spinous dorsal with dark margin, dark spot on membrane behind each dorsal spine and ray forming a black line along dorsal fin.

*Air bladder* (Plate, 7) : Caecae 17 to 20. Branches of caecae slender and long ; type of branching different from that of others ; last caecum undivided. In some specimens the number of caecae on both sides is equal, in others a difference of 1 is noted. Length of air bladder 34.18 to 43.93.

A total of 145 specimens between 32.5 mm. and 190.0 mm. were collected between October and June in small numbers.

## 3. *Nibea sina* (Cuv. & Val.)

*Corvina sina* Cuvier & Valenciennes, 1830, Hist. Nat. Poiss. 5 : 122. (Type locality : Pondicherry, Malabar).

*Diagnosis* : D. X+I 26-29, A. II 7, P. 15-19, V. I 5, Vert. 25.

Depth 31.43 to 31.78 ; head length 31.78 to 32.86 ; snout 8.18 to 8.67 ; eye 6.63 to 7.12. Jaws more or less equal. 4 big and 2 small pores on chin. Anal origin before middle of soft dorsal. Origin of spinous dorsal above that of pectoral. 3rd and 4th dorsal spines longest. Opercle with 2 flat spines and preopercle with 2 or 3 small spines. Scales on head and opercle cycloid and on body ctenoid. G.R. 5-7+11-15.

*Colour* : Brown above, silvery with gold reflections below. Spinous dorsal black, other fins grey. Ventrals white.

*Air bladder* (Plate, 8): Air bladder resembles that of *J. carutta*, *J. dussumierii* and *J. belengerii* but caecae 16 to 17. Anteriorly, air bladder is attached to depressions on 2nd, 3rd and 4th vertebrae. Length of air bladder 42.22 to 43.40.

Number of specimens examined 60, between 35 mm. and 190 mm.

Genus DENDROPHYSA Trewavas, 1964

Type : *Umbrina russelli* Cuvier, 1830

This genus resembles *Johnius*, but can be distinguished by the presence of a solid barbel below chin. Lower jaw shorter than upper jaw. The genus was created by Trewavas (1964) to include three species of Indo-West Pacific sciaenids described by earlier workers under *Umbrina* or *Sciaena*. Two of them occur at Visakhapatnam.

KEY TO THE SPECIES OF *Dendrophysa*

- 1a. Barbel robust, equals half diameter of eye, scales on head and body cycloid, dorsal fin rays 23 to 26. Air bladder with 14-15 caecae. Posterior end of air bladder long and pointed.....*dussumierii*
- 1b. Barbel small, scales on head cycloid and on body ctenoid. Dorsal fin rays 27 to 31. Air bladder with 11 caecae. Last caecum extends behind blunt posterior end of air bladder.....*macroptera*

1. *Dendrophysa dussumierii* (Valenciennes)

*Umbrina dussumierii* Valenciennes, 1833, Hist. Nat. Poiss. 9:481. (Type locality: Coromandel).

*Diagnosis* : D. X+I 23-26, A. II 7, P. 16-17, V. I 5, Vert. 25.

Depth 29.22 to 31.32 ; head 29.62 to 30.36 ; snout 8.32 to 8.68 ; eye 7.62 to 8.02. Upper jaw overlaps the lower; chin with 5 pores. A robust barbel equal to half eye diameter. Scales on head and body cycloid. 2nd, 3rd and 4th dorsal spines with filamentous prolongation, 2nd and 3rd the largest, almost as high as body, the 4th slightly shorter. G.R. 3.4+8-10.

*Colour* : Dark brown, with metallic reflections below. Spinous dorsal dark, other fins black except ventral which is yellow.

*Air bladder* (Plate, 9) : Hammer-shaped with 14 to 15 caecae. The posterior part is long and pointed. Last one or two caecae on either side undivided. Length of air bladder 37.82 to 38.02.

A total of 22 specimens between 47.5 mm. and 163.0 mm. were examined.



## 2. *Dendrophysa macroptera* (Bleeker)

*Umbrina macropterus* Bleeker, 1863, Nat. Tijds. Nederland. Indie, 4 : 254. (Type locality : Priaman, Sumatra).

*Diagnosis* : D. X+I 27-31, A. II 7, P. 14-18, V. I 5, Vert. 25.

Depth 28.42 to 30.06 ; head 27.36 to 30.49 ; snout 8.89 to 10.30 ; eye 6.97 to 7.41. A symphyiscal barbel shorter than pupil with a barbel pore and with 2 conspicuous pores on either side of the median one. Scales on head, opercle and cheeks cycloid and on body ctenoid. G.R. 3-5+8-10.

*Colour* : Brown above, light brown below. A dark mark on opercle. Fins yellowish, dotted with brown.

*Air bladder* (Plate, 10) : Hammer-shaped with 11 caecae on either side. Third caecum is shorter and more branched than others ; it arises behind the anterior bulged part of bladder unlike in *Johnius carutta*, *J. dussumierii*, *J. belengerii*, *Nibea sina* and *Dendrophysa dussumierii* in which it arises on the posterior part of the bulged part. Last caecum is branched and extends behind body of air bladder. Length of air bladder 36.84 to 45.82.

48 specimens between 60 mm. and 190 mm. were examined.

### Genus OTOLITHOIDES Fowler

Fowler, 1933, Bull. U.S. Nat. Mus. 12 : 364. Type *Otolithus biauritus* Cantor.

Lower jaw slightly shorter than upper ; 6 pores on chin, 2 of them smaller than others. Teeth in narrow villiform bands in both jaws ; in upper jaw, the outer row is constituted of 4 strong caniniform teeth, which are seen even when the mouth is closed. Only a single specimen of one species of *Otolithoides* : *O. brunneus* (Day) was observed in the catches.

#### 1. *Otolithoides brunneus* (Day)

*Otolithus brunneus* Day, 1873, Journ. Linnean Soc. London, 11 : 524. (Type locality : Bombay).

*Diagnosis* : D. X+I 26, A. II 7, P. 18, V. I 5.

Depth 27.75 ; head 28.46 ; snout 7.32 ; eye 7.25. Body shape resembles that of *Otolithes argenteus* but lower jaw is shorter than upper. All the generic characters are present. Height of soft dorsal gradually increases to last ray. Caudal pointed. Anal origin below 8th dorsal ray. G.R. 5+9.

*Colour* : Brownish above, with gold reflections below.

*Air bladder* (Plate, 11): Caecal outgrowths 25-26. Like width of air bladder, length of caecae also decreases gradually toward posterior end. Anteriorly air bladder is oval and caecae are longer than width of air bladder. Posterior end is bluntly pointed. Length of air bladder was 54 mm. in the specimen of 174 mm. standard length.

### Genus OTOLITHES Oken

Oken, 1817, Isis, p. 1782. Type *Johnius ruber* Bloch.

The genus is characterised by the presence of conical teeth in both jaws. Lower jaw prominent. Second dorsal fin long. Body more elongated than in *Johnius* and *Dendrophysa*. Caudal truncate or pointed.

Of the three species of *Otolithes* recorded from Indian waters, 2 species occur along Visakhapatnam coast, *O. ruber* and *O. argenteus*.

#### KEY TO THE SPECIES OF *Otolithes*

- 1a. G.R. 8+16, Anal origin below 16th dorsal ray, air bladder with 25-26 much branched caecae.....*ruber*
- 1b. G.R. 4-7+9-12, Anal origin below 12th dorsal ray, air bladder with 30-35 caecae.....*argenteus*

#### 1. *Otolithes ruber* (Schneider)

*Johnius ruber* Schneider, 1801, Syst. Ichth.: 75, pl. 17. (Type locality: Tranquebar).

*Diagnosis* : D. X+I 28, A. II 7, P. 17, V. I 5.

Depth 29.68; head 28.96; snout 8.42; eye 6.26. The caniniform teeth, so characteristic of the genus were missing perhaps because of struggle in the boat seine in which it was caught. Lateral line curves to above middle of anal. Anal origin below 16th dorsal ray. G.R. 8+16.

*Colour* : Light brown. Spinous dorsal with black edge, soft dorsal and anal with grey edges. Other fins yellow.

*Air bladder* (Plate, 12, 12A and 12B). Day (1878) described the air bladder of *O. ruber* as having 34 lateral processes; the single specimen examined had only 25 caecae on one side and 26 on the other. Each caecum is divided into 3 branches of which the main branch extends perpendicularly to the lateral margin of the air bladder. From this main branch are given off one dorsal and one ventral branch. Standard length was 148 mm. and length of air bladder 71 mm.

Rare. The single specimen collected in May measured 148 mm.

2. *Otolithes argenteus* Cuv. & Val.

*Otolithes argenteus* Cuvier & Valenciennes, 1830, Hist. Nat. Poiss., 5: 62.  
(Type locality: Batavia, Malabar, Malacca).

*Diagnosis*: D. X+I 27-31, A. II 7, P. 14-16, V. I 5, Vert. 25.

Depth 23·14 to 28·34; head 30·79 to 31·98; snout 6·76 to 8·37; eye 5·23 to 7·43. Lower jaw prominent. Operculum with 2 spines. No pores either on snout or on chin. Teeth in upper jaw in villiform band; anteriorly one or two strong, curved long caniniform teeth, the outer the largest. In mandible on each side, a strong curved symphyseal caniniform tooth placed between the 2 upper ones. Second anal spine weak. Dark blotch on opercle. G.R. 4·7+9·12.

*Colour*: Brown with silvery reflections, darker along back. Edge of dorsal dusky; other fins yellowish.

*Air bladder* (Plate, 13, 13A, 13B and 13C): Anterior part of air bladder is oval; caecae 30 to 35. The number of caecae on the two sides may be equal or there may be a difference of  $\pm 1$  on one side. The caecae are arranged close together with little space between. Each caecum is much branched and one cluster of branches of each caecum is folded on to the dorsal side of the air bladder. The branching of the caecae increases with growth. Length of air bladder 35·22 to 49·02.

84 specimens between 44·1 mm. and 255·0 mm. were examined.

TABLE I  
MERISTIC DATA OF SCIAENIDS

Species	Dorsal	Pectoral	Gill rakers	Vertebrae
<i>Johnius carutta</i>	.. X+I 26-29	14-17	3-5+7-10	25
<i>J. aneus</i>	.. X+I 23-25	15-17	4-7+9-14	25
<i>J. dussumierii</i>	.. X+I 26-30	15-18	4-7+10-14	25
<i>J. belengerii</i>	.. X+I 28-29	17	3-7+9 short	25
<i>J. axillaris</i>	.. X+I 25-29	15-18	9-12+19-23	24
<i>Nibea maculata</i>	.. X+I 22-24	16-18	4-5+7-9	25
<i>N. soldado</i>	.. X+I 23-26	15-17	4-7+10-14	25
<i>N. sina</i>	.. X+I 26-29	15-19	5-7+11-15	25
<i>Dendrophysa dussumierii</i>	.. X+I 23-26	16-17	3-4+8-10	25
<i>D. macroptera</i>	.. X+I 27-31	14-18	3-5+8-10	25
<i>Otolithoides brunneus</i>	.. X+I 26	18	5+9	—
<i>Otolithes ruber</i>	.. X+I 28	17	8+16	—
<i>O. argenteus</i>	.. X+I 27-31	14-16	4-7+9-12	25

*Note*.—The number of spines and rays in anal and ventral fins is constant in all the species and specimens examined: II 7, and I 5 respectively.

## DISCUSSION

*Structure of Air Bladder and its relevancy to phylogeny and classification :*

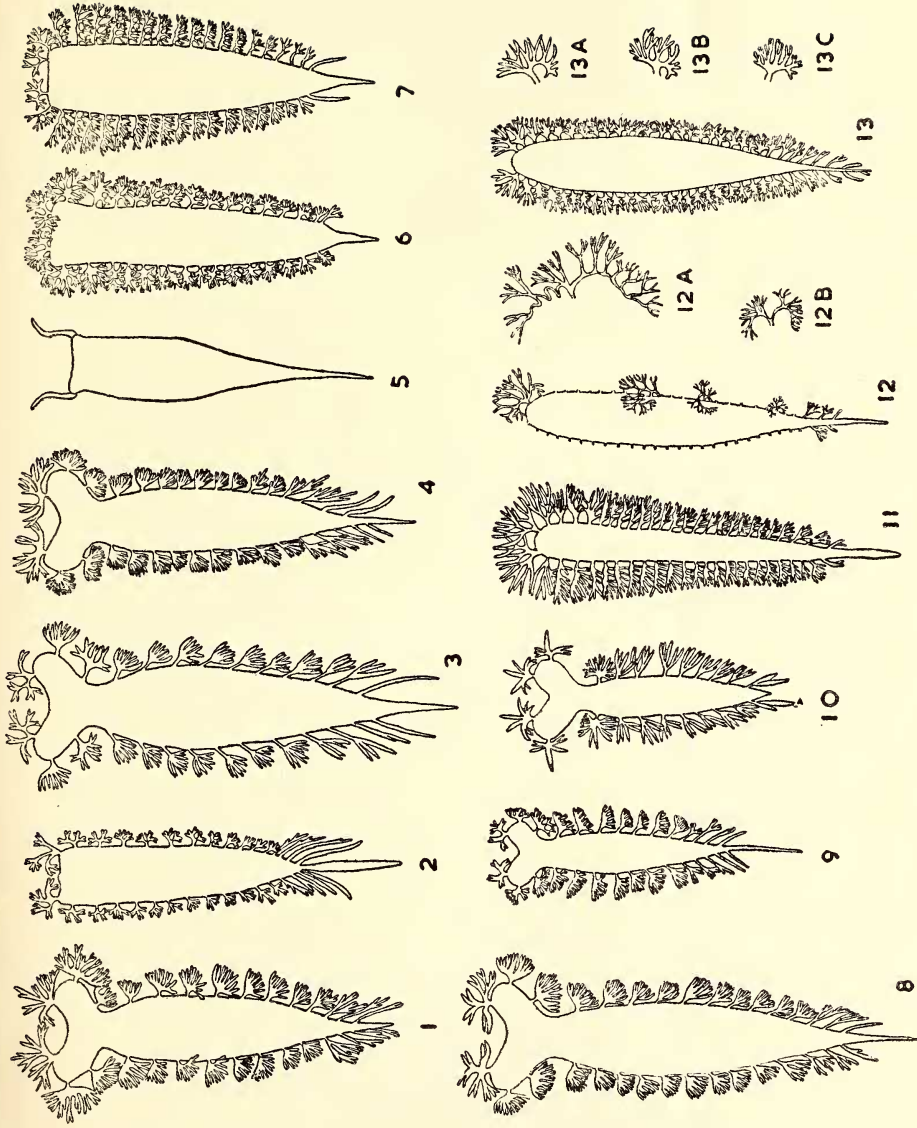
Trewavas (1962, 1964) has stated that the primary divisions of the family Sciaenidae may be based on the ground plan of the air bladder where this is complex, 'complex' to mean such species in which the air bladder has arborescent appendages.

Our studies on thirteen Indo-West Pacific sciaenids which occur at Visakhapatnam on the east coast of India (western part of Bay of Bengal) indicate the need for circumspection in accepting entirely Trewavas' grouping of sciaenid species on the basis of the structure of the air bladder and its relevance to phylogeny and classification :

1. Six species of three different genera—three species of *Johnius* : *dussumierii* (Cuvier), *belengerii* (Cuvier) and *carutta* Bloch, one of *Nibea* : *sina* (Cuvier), and two of *Dendrophysa* : *macroptera* (Blkr.) and *dussumierii* (Val.) possess hammer-shaped air bladders with arborescent appendages (Tribe Otolithini). If Trewavas' principle were to be strictly applied, then on the basis of similarity of air bladder, *N. sina* (and the two species of *Dendrophysa*) would have to be considered closer to the above three species of *Johnius* than to the other two species of *Nibea* (*vide* 2 below) ; the above three species of *Johnius* would be closer to *N. sina* and the above two species of *Dendrophysa* than to *J. aneus* Bloch.

2. Six other species of four genera : one of *Johnius* : *aneus* Bloch, two species of *Nibea* : *maculata* (Schn.) and *soldado* (Lac.), one of *Otolithoides* : *brunneus* (Day) and two species of *Otolithes* : *ruber* (Schn.) and *argenteus* Cuvier have carrot-shaped air bladders with arborescent appendages. Again, if Trewavas principle were to be applied, these two species of *Nibea* (as also *Otolithoides brunneus* and the two species of *Otolithes*) would have to be considered closer to *J. aneus* than to *N. sina*. *J. aneus* would be closer to the above species than to the other three species of *Johnius* (*vide supra*).

3. *Johnius axillaris* (Cuvier), 1830 possesses all the characters of genus *Johnius* as defined by Trewavas (1964 : 110) except that the air bladder lacks arborescent appendages. Since she states that her definition of *Johnius* 'excludes species with gas bladders of a different pattern' i.e. species with air bladder lacking arborescent appendages, we would have to remove *J. axillaris* from the genus and from tribe Otolithini and place it in tribe Sciaenini or perhaps with genus *Larimus* because the simple air bladder of *J. axillaris* bears two (horn-like) outgrowths anterolaterally as in *Larimus* (*vide* Trewavas, 1962: 168, fig. 1A). But probably Trewavas no longer recognises her tribe Otolithini (which she created to include *Johnius*, *Otolithes*, *Argyrosomus*, *Dendrophysa*



General structure of the air bladder in the Sciaenidae spp.

1. *Johnius carutta*; 2. *J. aneus*; 3. *J. dussumierii*; 4. *J. belengerii*; 5. *J. axillaris*; 6. *Nibea maculata*; 7. *N. soldado*; 8. *N. sina*; 9. *Dendrophysa dussumierii*; 10. *D. macroptera*; 11. *Otolithoides brunneus*; 12. *Otolithes ruber*; 12A. One of the middle caecal outgrowths of *O. ruber*; 12B. One of the posterior caecal outgrowths of *O. ruber*; 13. *O. argenteus*; 13A. One of the anterior caecal outgrowths of *O. argenteus*; 13B. One of the middle caecal outgrowths of *O. argenteus*; 13C. One of the posterior caecal outgrowths of *O. argenteus*.